Naval Medical Research Unit Dayton
Wright-Patterson AFB, Ohio

Science Update

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MISSION

To maximize warfighter performance and survivability through premier aeromedical and environmental health research-delivering solutions to the field, the Fleet, and for the future.

VISION

NAMRU-D is Navy Medicine's world class, global aeromedical and toxicology research leader. Our efforts and innovative products are aligned with operational requirements to solve the naval and joint warfighter challenges of the future.

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2nd Annual 711 HPW + NAMRU Dayton Open House a Success!

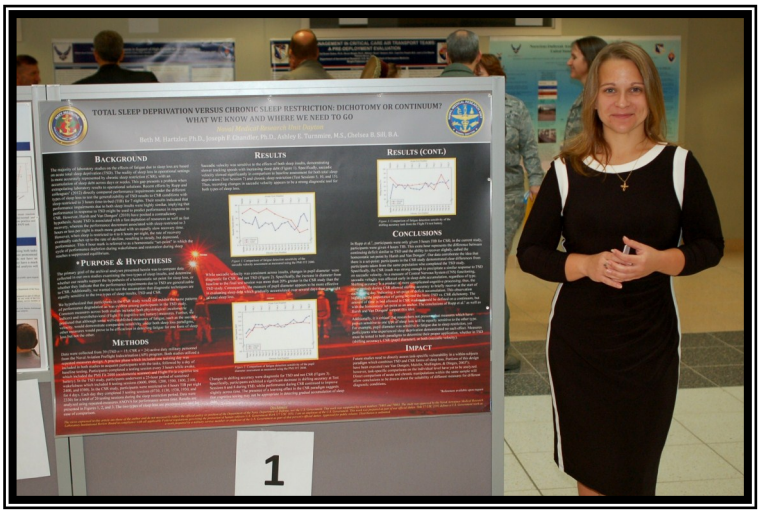
NAMRU Dayton Public Affairs

The Naval Medical Research Unit Dayton (NAMRU-D) participated in the 2nd Annual 711th Human Performance Wing (711 HPW) + NAMRU Dayton Open House at Wright-Patterson Air Force Base on Oct 30, 2013.

The open house emphasized collaborative efforts in military medicine research.

This year's day-long open house included a poster session for researchers to present published studies. More than 30 posters were on exhibit in the Atrium of the U.S. Air Force School of Aerospace, which also set the scene for the 300-plus tour attendees to join together for lunch.

Brigadier General Jex, Commander, 711 HPW and Captain Andrews, CO, NAMRU-D, encouraged the Annual Open House as it serves as a platform for exchanges of knowledge to improve the lives of our warfighters.



Dr. Beth Hartzler presents her team's research on total sleep deprivation versus chronic sleep restrictions at the 2nd Annual 711 HPW + NAMRU-D Open House poster session.

Colonel Cassie Barlow, Commander of Wright-Patterson AFB is greeted by Captain Andrews during a tour of one of the NAMRU-D laboratories.

Over 25 unique programs were highlighted in the areas of human performance, aerospace medicine, and toxicology throughout the day.

Tour attendees were NAMRU-D and 711 HPW staff members. The NAMRU-D Environmental Health Effects Directorate tour included stops in the Submariner Health atmospheres inhalation Lab, the Jet Fuel plus noise inhalation exposure systems Lab, the Neurobehavioral Assessment Lab, the electrophysi-

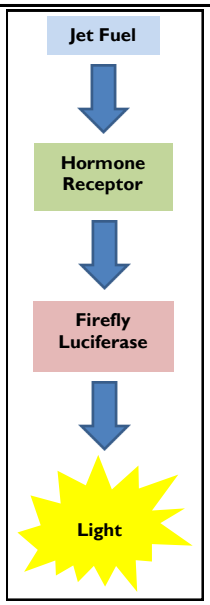
Story continues on bottom of page 2.

NAMRU Dayton Uses Animal Models and a Firefly Luciferase Assay to Study Reproductive and Endocrine Disruption Effects of Jet Fuels

CDR William R. Howard & Dr. Joyce G. Rohan

In order to protect the health of Sailors and other DoD service-members who are occupationally exposed to jet fuels, NAMRU Dayton is conducting a study to assess the male and female reproductive and fertility effects of standard jet fuels, along with a renewable jet biofuel derived from the seeds of the camelina plant. Taking into account evidence that jet fuel components are reproductive toxicants in both sexes, this study exposed male and female rats to jet fuels and then paired the rats for mating to study basic male and female reproductive function along with effects on conception and maintenance of pregnancy. Additionally, this study uses isolated human cells and human hormone receptors to help elucidate the underlying basic mechanisms of any endocrine disruptor activity attributable to the jet fuels.

The human cell studies for endocrine disruption represent a new capability at NAMRU-D that arose from collaboration with the Dr. Daniel Noonan at the University of Kentucky College of Medicine. These studies are conducted using human kidney cells and human hormone receptors in a firefly luciferase assay. Luciferase is an enzyme involved in a reaction resulting in the emission of light. In this assay, if hormone receptors are activated by jet fuels, the firefly luciferase will become active and the light produced can be measured in an instrument called a luminometer. Activation of the hormone receptors by jet fuels would represent a disruption of the normal functions of the endocrine system that is normally controlled by natural hormones.



Simplified diagram of the isolated human cell endocrine disruption assay using firefly luciferase.
If jet fuel activates the human hormone receptor, the activated hormone receptor will then activate the firefly luciferase in the assay. The activated firefly luciferase will emit light, which can be measured in an instrument called a luminometer.

Studies with animal models provide important insight into the consequences of jet fuel exposure on several readily observed parameters including mating behavior, fertility, implantation, fetal resorption, offspring sex ratios, and gross morphology. On the other hand, the isolated cell approach provides a glimpse at the potential actions of jet fuel on hormone receptors and gives valuable information on potential endocrine disruption. These assays can be used to investigate effects of other chemical or environmental hazards, further expanding NAMRU-D's capabilities in toxicological assessments.

Open House (cont.)

ology lab and the *In Vitro* Toxicology Laboratory. Tours of NAMRU-D's Aeromedical Directorate facilities included the Hypoxia Lab, Fatigue Lab, Spatial Disorientation Countermeasures Lab, and the Disorientation Research Device.

Dr. Lisa Sweeney answers questions at the NAMRU-D display at the 2nd Annual 711 HPW + NAMRU-D Open House poster session.

Colonel Cassie Barlow, 88th Air Base Wing and Installation Commander, Wright-Patterson AFB toured through NAMRU-D spaces in addition to the Air Force labs and was escorted by LCDR Will Wells, Biomedical Sciences Department Head, NAMRU-D.

Overall, the 2nd Annual 711 HPW + NAMRU-D Open House was a success and informed tour attendees of the mission-essential work being conducted. On January 24, 2014 the 711 HPW + NAMRU Dayton Open House committee was nominated and awarded the Commander's Excellence Award at the 711 HPW Annual Awards Ceremony.

The 711 HPW + NAMRU-D Open House committee was nominated and awarded the Commander's Excellence Award at the 711 HPW Annual Awards Ceremony. The award was presented by BGen Jex (far left).

Wright-Patt AFB Issue Point Manager of the Quarter from NAMRU Dayton

NAMRU Dayton Public Affairs

On November 18, 2013 the Wright-Patterson AFB Issue Point Manager of the Quarter for the time period of Aug-Sept 2013 was presented to NAMRU Dayton's Mr. Matthew Roberts. NAMRU-D is proud of one of their own for achieving such high level skill as Issue Point Manager of the Quarter, which reflects a Hazmat manager with the migration to EESOH-MIS. CO recognized Roberts in front of command members during an awards presentation on November 18. Mr. Michael Vaughn, Hazardous Material/ Emergency Response Project Management at WPAFB was present during the presentation of award.

CAPT Andrews (left) recognized Mr. Roberts as Issue Point Manager of the Quarter at Wright-Patt AFB.

The award recognizes incomparable tracking and controlling of hazardous materials, innovative approach, and exceptional in relation to his counterparts for the specific time period of the award.

"Roberts is an active participant at each monthly Hazardous Substance Steering Group meeting and also at the Quarterly Hazmat Managers meeting. He aggressively pursues opportunities to utilize the functionality of the tracking system and goes the extra step to convey what he is doing to both his counterparts and to the management section…within the Environmental Management branch of Civil Engineering."

~ Mr. Vaughn, Hazardous Material/Emergency Response Project Management, Wright-Patt AFB

The award reflects unparalleled professionalism in an individual and also supports the progress that NAMRU Dayton is capable of reaching and surpassing in multiple arenas. Please join us in congratulating Mr. Matthew Roberts!

NAMRU-D Participates in Workshop on Alternative Fuels

Dr. Karen L. Mumy

The science behind alternative fuels has greatly advanced in recent years. These non-conventional fuels may be derived from fats or vegetable oils, or may be biomass or algal-based. Fuel chemists and engineers have developed processes that take these everyday sources and convert them into various fuel forms that function similarly to the more traditional fuels. The development of these fuels continues to be of great interest to the Department of Defense, as well as commercial airlines, as they reduce the reliance on fossil fuels and make strides towards a cleaner environment. The Naval Medical Research Unit Dayton (NAMRU-D) has been at the forefront of the DOD's alternative fuel efforts by helping to provide toxicological, health and risk assessments. Towards this, NAMRU-D participated in the third annual Toxicology Perspectives on Jet & Alternative Fuels Workshop held 19 November 2013 at Tec^Edge Innovation and Collaboration Center in Dayton, OH. This workshop brought together leaders in fuel toxicology from industry, the DOD and the Environmental Protection Agency.

An F/A-18 from the Blue Angels demonstration squadron is fueled with a biofuel blend. Photo: U.S. Navy

Dr. Karen Mumy, NAMRU-D team member and Deputy Director of the Environmental Health Effects Directorate provided a briefing in conjunction with Dr. David Mattie (toxicologist, US Air Force Research Laboratory). Their joint briefing highlighted the collaborative efforts of Navy and Air Force in assessing potential toxicity associated with exposure to alternative jet fuels currently being tested for military use. Different types of alternative fuels were discussed representing the various processes by which alternative fuels are generated, including Fischer-Tropsch, alcohol-to-jet and hydroprocessing. These processes result in fuels similar in chemical content to the conventional form of Jet Propulsion-8 currently in use by the military. Drs Mumy and Mattie discussed data based on toxicity studies using both animal and bacterial models to assess the physical and neurobehavioral effects as well as potential mutagenicity of fuel exposure.

Other briefings and discussions focused on regulatory and risk assessment issues, and the ability to chemically compare these different fuels using computer software currently under development by the US Air Force. This workshop offers an opportunity for experts in the field to discuss recent progress and advancements in generating and testing the fuels for operational use.

USAF School of Aerospace Medicine AAMIMO Students Visit NAMRU Dayton

Dr. Richard Arnold

Dr. Kirkendall describes Navy color vision testing research that NAMRU-D is currently conducting in the lab.

On 4 Feb 2014 seven international flight surgeons attending the USAF School of Aerospace Medicine's Advanced Aerospace Medicine for International Medical Officers (AAMIMO) course visited NAMRU Dayton to learn about US Navy aeromedical research initiatives. The AAMIMO course is designed to provide advanced training for students who have already completed the USAF primary course in aerospace medicine, or its equivalent. A substantial component of the course is familiarization visits to US aerospace medicine facilities throughout the US. NAMRU-D's Aeromedical Directorate has long supported the AAMIMO course, previously as NAMRL, NAS Pensacola, and now for the second consecutive year in Dayton.

The 2014 AAMIMO class consists of students from India, Tunisia, Denmark, Pakistan, and Japan.

Left: AAMINO students are briefed with the Disorientation Research Device lab capabilities by CDR Richard Folga.

Right: Dr. Phillips explains his team's research efforts on delayed cognitive recovery following hypoxia.

During the visit a number of public domain briefings and lab tours were provided. Dr. Jeffrey Phillips provided an overview of his research into delayed cognitive recovery following hypoxia. Dr. Henry Williams and CDR Richard Folga provided tours of NAMRU-D spatial orientation research labs, including demonstrations of recently validated simulation-based in-flight visual illusion scenarios. Dr. Lynn Caldwell provided an overview and tour of the Cognitive Readiness and Resilience Laboratory. Dr. Cristina Kirkendall described Navy color vision testing research. Dr. Eric Littman discussed motion sickness countermeasures research, and LCDR Wilfred Wells covered the role of whole body vibration on helicopter pilot neck and back pain.

The visit served not only to introduce the AAMIMO students to Navy aeromedical research initiatives, but also to introduce NAMRU-D scientists to international colleagues in aerospace medicine, establishing important new professional relationships. NAMRU-D's support of the AAMIMO program enhances the excellent collaborative relationship NAMRU-D has established with our Air Force hosts and partners at Wright-Patterson AFB, which ultimately enhances our mutual capacity to support the joint warfighter through research.

NAMRU-D Products & Presentations

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Howard, W.R., Wong, B.A., Okolica, M., Bynum, K.S. James, R.A. (July 2013). *The Prenatal Development Effects of Carbon Dioxide (CO2) Exposure in Rats (Rattus Norvegicus).* Retrieved from http://www.dtic.mil/get-tr-doc/pdf?AD=ADA583166.

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Commanding Officer's Corner

CAPT Jeffrey Andrews

Captain Jeffrey M. Andrews, MSC, USN
Commanding Officer

This edition of our science update brings the end of a very cold and bitter winter combined with a high personnel turnover, an uncertain federal budget and the survival of another continuing resolution. Despite these historically adverse conditions, the NAMRU-D team has thawed out and continues to thrive and produce impressive results with growing capabilities that are fleet relevant and focused on joint warfighter performance and survivability. It has been said that pain builds character, this has been tested here the past few months and I am happy to report not only have we survived the pain, but we are better than before. I continue to be impressed with the professionalism, positive spirit, and flexibility of our staff and greatly appreciate and respect all efforts and exceeding expectations.

Both our science directorates are actively engaged in research protocols for our sponsors, specifically joint projects awarded for sand, burn pit and jet fuel biomarkers, fatigue, hypoxia sensors, and spatial disorientation. In this update you will find details of the cutting edge research with jet fuel toxicity and essential participation in health and risk assessments of alternative fuels for operational use.

We had the unique opportunity to showcase our capabilities at the 2nd annual 711th Human Performance Wing (HPW) / NAMRU-D Open House. Special thanks to BGen Jex for his leadership and vision to initiate this event. It proved to be a successful educational outreach that reinforced the pursuit of jointness in our missions and highlighted the importance of efficiency through elimination of duplication. The 711th HPW and NAMRU-D were able to network and leverage unique skills and share valuable resources and talent. The annual Toxicology Science & Technology Consortium hosted by NAMRU-D and visits by international flight surgeons, VIPs, and dignitaries are more examples of the pursuit of collaboration and jointness in our research missions.

As spring brings overdue relief from a long, hard winter, the work and energy will heat up and our capabilities will continue to expand. NAMRU-D stands ready for any challenge and invites research opportunities and tours, please come visit us. Thanks again to all for your dedicated efforts, impressive achievements, and loyal support. Keep climbing.

Taking the Helm of Navy Medicine's Aeromedical & Environmental Health Research

NAMRU Dayton

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